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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/556,930

11/14/2005

Takashi Abe

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EXAMINER

DAHIMENE, MAHMOUD

ART UNIT

PAPER NUMBER

1792

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PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/556,930	<b>Applicant(s)</b> ABE ET AL.	
	<b>Examiner</b> MAHMOUD DAHIMENE	<b>Art Unit</b> 1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 02 May 2008.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1 and 4-6 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,4-6 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)            | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | Paper No(s)/Mail Date. _____                                      |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>5/2/08</u> .  | 6) <input type="checkbox"/> Other: _____                          |

## DETAILED ACTION

### ***Claim Rejections - 35 USC § 112***

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claim 1 and dependent claims are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. The limitation "the thickness profile is given to the resist mask by exposing the resist mask to a light source under the condition that the resist mask is irradiated with a smaller quantity of light at its periphery than at its center" contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. Since applicant's invention is intended for "at provision of piezoelectric material, which is precisely shaped to a three-dimensional configuration by a new process suitable for production of oscillators with large surface areas, micro-miniaturization, dense integration and an increase of designing freedom." (Specification paragraph 0007), It is not clear how, in a micro-miniaturization scale, the resist mask is irradiated with a smaller quantity of light at its periphery than at its center. The state of the prior art describes in details how the mask profile is obtained in a micro-

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miniaturization scale, however, the key invention of applicant's claim, and what differentiates it from the prior art, is that, in applicant's claimed method, the shape the resist mask by is specifically obtained by irradiation with a smaller quantity of light at its periphery than at its center, this concept is easily understood for large scale features where an obstruction of light is used at the periphery of the feature, however, it is not clear how the light obstruction can be applied in the state of the art micro-miniaturization scale. No working example is provided for such a method.

### ***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 1, 4, 5, and 6, are rejected under 35 U.S.C. 103(a) as being unpatentable over Barber et al. (US 2002/0022292) in view of Wu et al. (US 6,562,523) and Wolf et al. (Silicon Processing for the VLSI Era, Volume 1- Process Technology, Lattice Press, 1986).

Regarding claims 1 and 6, the reference of Barber discloses a method of shaping thin film piezoelectric resonators, summarized in figure 3, which includes all the limitations of depositing a resist mask, reforming the mask and dry etching. Barber cites "Material removal or an etching process can be used to transfer a shaped pattern in a resist to a shaped pattern in the piezoelectric material being removed." (paragraph 0009).

It is noted Barber is silent about irradiating the mask for shaping the resist as described in applicant's claim 1.

Wu teaches resist is conventionally reshaped using different degrees of radiation. In figure 13, Wu shows reforming a resist mask figure 13 (c) to a predetermined ,thickness profile figure 13 (d), wherein the thickness profile is given to the resist mask by exposing the resist mask to a light source under the condition that the resist mask is irradiated with a smaller quantity of light at its center than at its periphery and developing the irradiated resist mask.

It is noted that Wu discloses the resist mask is irradiated with a smaller quantity of light at its center than at its periphery not "the resist mask is irradiated with a smaller quantity of light at its periphery than at its center " as required in applicant's claim 1. However, it would have been obvious to one of ordinary skill in the art at the time the

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invention was made to use a negative resist instead of the positive resist used by Wu to obtain the complementary image from the same type of mask since positive and negative resists are conventionally known to yield complementary features as suggested by Wolf (pages 407-408, and figure 1).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Barber by using the modified irradiation resist shaping method of Wu because Wu discloses such a method is conventionally known.

One of ordinary skill in the art would have been motivated to use the resist shaping of Wu in order to obtain a more reliable pattern than the letting method since melting is less controllable than exposing.

One of ordinary skill in the art would have been motivated to use a negative resist as opposed to a positive resist when the higher resolution of positive resist (for which it is typically used as suggested by Wolf (page 408, line 6) is not required.

As to claim 4, Barber teaches "Utilizing an etching process (for example, reactive ion etching, wet chemistry or focus ion beam milling (FIB)), the resist 25 and material 21 are then etched at the required rates (as set forth in the etching process) such that the final structure 26 possesses the desired amount of doming, contouring or shaping for guiding the acoustic waves to the center of the resonator." , "If the removal rate of the material and resist is equal in any of the above material removal processes, the initial pattern which existed in the resist will be exactly reproduced in the material beneath the

resist. If, however, the resist is removed at a rate which is half the rate of the removal of the underlying material for example, the initial pattern will be scaled as it is transferred to the underlying material.”, finally “For example, change the type of reactive gas used during RIE, change the chemicals in which the wet etch is performed or change the type of chemicals used to perform the CMP. This provides greater flexibility during etching, and permits the creation of a broader range of final shapes.”(paragraph 0029).

It is noted that Barber does not expressly disclose “the dry etching is started with a less selectively reactive gas for reforming the resist mask to a predetermined thickness profile and then continued with an etching gas having high selective reactivity to the piezoelectric material”, however, Barber clearly teaches the concept of choosing selectivity of the etch step(s) to shape the material. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to select the proper removal rate of the resist versus piezoelectric material including the case where the dry etching is started with a less selectively reactive gas for reforming the resist mask to a predetermined thickness profile and then continued with an etching gas having high selective reactivity to the piezoelectric material, because Barber teaches the broad concept of tailoring the etch steps to obtain a desired shape.

As to claim 5, for example, antireflective coating are very well understood to be deposited films on the surface of the substrate prior to depositing the resist mask.

***Response to Arguments***

6. Applicant's arguments, filed 5/2/2008, with respect to the rejection(s) of all pending claims claim(s) have been fully considered and are persuasive in view of the new amendments regarding the resist shaping method. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Wu et al. (US 6,562,523) and Wolf et al. (Silicon Processing for the VLSI Era, Volume 1- Process Technology, Lattice Press, 1986).

***Conclusion***

7. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.



Any inquiry concerning this communication or earlier communications from the examiner should be directed to MAHMOUD DAHIMENE whose telephone number is (571)272-2410. The examiner can normally be reached on week days from 8:00 AM. to 5:00 PM..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/M. D./  
Examiner, Art Unit 1792

/Nadine G Norton/

Supervisory Patent Examiner, Art Unit 1792